



energie atomique • energies alternatives

CADARACHE



The expertise of the « **Groupe de Recherches Appliquées en Phytotechnologie (GRAP)** » consists in developing, managing and improving culture chambers dedicated to the production of plants in environmentally controlled conditions.

This platform accommodates a large variety of facilities and experiments in collaborative research or in partnership contracts (**insured confidentiality, quality process** complying with the ISO9001v2000 standard).

## INSTALLATIONS

➤ **A set of measuring chambers** to monitor and quantify plant growth. The 16 measuring chambers have adjustable volumes (from a few liters to 1500 liters). They are hermetically closed modules in which several environmental parameters can be continuously measured and precisely regulated. A broad range of parameters can be manipulated throughout the growth cycle, lasting up to several months:

- atmospheric gaseous composition, isotopic labelling (CO<sub>2</sub> with different ratios of <sup>12</sup>C and <sup>13</sup>C, O<sub>2</sub>, other gases )
- temperatures (from 1 to 50°C)
- relative humidity (from 20 à 80%)
- plant nutrition (qualitative and quantitative control), <sup>15</sup>N
- irradiance levels (up to about 2000 μmol photons.m<sup>-2</sup>.s<sup>-1</sup>) and light periods.

Moreover, gaseous exchanges between plants and their environment (photosynthesis, respiration, transpiration, ...) can be continuously measured.



➤ **A set of 9 phytotrons** and 2 *in-vitro* class 2 growth chambers, approved for the culture of GMO, providing a useful surface area for the production of about 20000 *Arabidopsis* plants simultaneously. Various environments (particularly different light periods) may be used, allowing the culture of different plant species (tobacco, wheat, maize, ...).

➤ **A multipurpose laboratory** (phytotrons, incubators, beta and gamma counters, STORM phosphorimager, equipment for molecular biology, microbiology ) located in a **controlled zone and dedicated to experiments with radionuclides** on plants, microalgae or bacteria.



## A MULTI-FIELD TEAM integrated into a Research Institute of 130 members

The GRAP team (about 10 people), managing, developing and ensuring technical maintenance of the platform, gathers competences in:

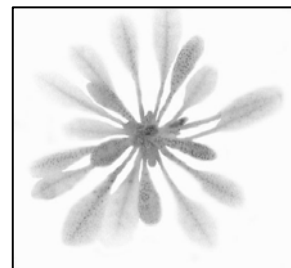
- Plant Biology
- Process control and command system
- Instrumentation, physical measurements, electronics and robotics.
- Maintenance, mechanical and electromechanical improvements
- Quality management



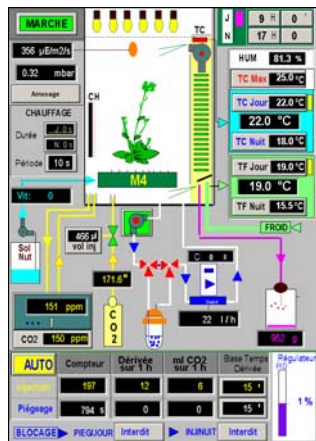
photo-oxidative stress  
(high light, low temperature)  
on *Arabidopsis thaliana*

## TECHNOLOGIES AND EQUIPMENTS

- Computerized supervision system allowing a complete traceability (data historical, alarms, events).
- Telesurveillance of the installations
- Research and Development
- Hosts Laboratory



*Arabidopsis thaliana* leaves  
labelled with  $^{109}\text{Cd}$   
(Phosphorimager)



## QUALITY MANAGEMENT

The GRAP has developed a quality process based on the ISO 9001 standard. The organization system thus established is precisely described at the operational and organizational levels in procedures, instructions and orders. The GRAP « **Handbook of Quality Practices** » illustrates the team involvement in this field. The reliability of this Platform is increased by the use of a **Computer-aided Maintenance Management System**. It allows the follow up and the maintenance of the infrastructures (equipments and apparatus) as well as the use of supervision and measurements devices ensuring the metrological quality of our installations and apparatus.

The platform is supervised at all times, all the year, by a member of the GRAP thanks to an « on call » system at home.



This Platform has been certified by the GIS IBiSA (Infrastructures en **B**io**i**ologie **S**anté et **A**gronomie). It gathers in a same area technical, scientific and human means intended for providing to all the users high level technological resources and associated measurements in plant culture.

## PARTNERSHIPS AND CONTRACTS

- IMAPLANT Contract: development of a new generation of measuring chambers (lighting, temperature regulation) equipped with imaging systems (fluorescence, infrared cameras...) for addressing weak phenotypic variations (IBiSA, CEA/CNRS).
- INRA (Toulouse, Nancy, Dijon...)
- National (AFSSET, ANR, ADEME...) and European projects



LEDs-based experiment



$^{13}\text{C}$  et  $^{15}\text{N}$  enriched beech

## KEY WORDS RESEARCH TOPICS

- Culture under controlled conditions
- Isotopic labelling ( $^{13}\text{C}$ ,  $^{15}\text{N}$ ,  $^{109}\text{Cd}$ ...)
- Modified atmospheric gaseous composition
- Environmental stresses
- Environmental toxicology
- Photosynthesis, Respiration
  
- Quality process
- Non-disclosure agreement

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